CLAIMS

What is claimed is:

1.   A method for hiding information in images, the method comprising the operations of:

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        providing information sought to be hidden;

        preparing the information sought to be hidden for insertion into an image;

        providing image data configured as a plurality of bit planes;

        selecting a suitable bit plane from among the plurality of bit planes for the insertion of the information; and

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        inserting the information sought to be hidden into the image.

2.   A method as in Claim 1, wherein the operation of inserting the information sought to be hidden into the image comprises inserting the information into the suitable bit plane.

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3.   A method as in Claim 1, wherein the operation of preparing the information sought to be hidden for insertion into an image includes encoding the information.

4.   A method as in Claim 3, wherein the operation of preparing the information
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further includes the step of encrypting the information.

5.   A method as in Claim 3, wherein the information comprises watermark information.

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6.   A method as in Claim 4, wherein the information comprises watermark information.

7.   A method as in Claim 3, wherein the information comprises messages.

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8.   A method as in Claim 4, wherein the information comprises messages.

9. A method as in Claim 1, wherein the operation of providing an image data configured as a plurality of bit planes includes providing a plurality of bit planes wherein one of the bit planes defines a most significant bit plane and wherein another one of the bit planes defines a least significant bit plane.

10. A method as in Claim 9, wherein the operation of selecting a suitable bit plane from among the plurality of bit planes includes selecting a bit plane that is not the most significant bit plane and that is not the least significant bit plane.

11. A method as in Claim 9, wherein the operation of providing an image configured as a plurality of bit planes includes providing an image configured in at least eight bit planes numbered sequentially from the most significant bit plane to the least significant bit plane.

12. A method as in Claim 11, wherein the operation of selecting a suitable bit plane from among the at least eight bit planes includes selecting a bit plane that is not the most significant bit plane and that is not the least significant bit plane.

13. A method as in Claim 11, wherein the operation of selecting a suitable bit plane from among the at least eight bit planes includes selecting a bit plane from among the group of bit planes consisting of the fourth, fifth, sixth, and seventh bit planes.

14. A method as in Claim 11, wherein the operation of selecting a bit plane from among the at least eight bit planes includes selecting a fourth bit plane.

15. A method as in Claim 1, wherein the operation of selecting a suitable bit plane from among the plurality of bit planes includes:
conducting trial insertions of the information sought to be hidden into various bit planes to create trial images; and
comparing the trial images with an original image that does not have the inserted information until the trial image meets with some predetermined comparison criteria, and once a trial image meets with the predetermined criteria, the bit plane used to meet the predetermined criteria is selected as the suitable bit plane.

16.   A method as in Claim 1, wherein the operation of selecting a suitable bit plane and inserting the information includes,

        selecting more than one of the bit planes;

        introducing the information into each selected bit plane to create a series of trial images; and

        evaluating each of the trial images using an adaptive algorithm that compares and evaluates the image quality of the trial images with respect to an original image to select a suitable image plane.

17.   A method as in Claim 16, wherein the operation of introducing the information into each selected bit plane to create a series of trial images includes:

        dividing the selected bit plane into at least one block of pixels;

        analyzing at least one block of pixels to determine if it offers a suitable site for the introduction of said information into the selected bit plane; and

        introducing the information into the at least one block of pixels to create the series of trial images.

18.   A method as in Claim 9, wherein the operation of selecting a bit plane from among the plurality of bit planes includes:

        selecting an initial bit plane that is not the most significant bit plane and that is not the least significant bit plane;

        introducing the information sought to be hidden into a suitable site in the initial bit plane and generating a modified image;

        determining if the modified image is of satisfactory quality compared to an unmodified image; and

        if the modified image is of satisfactory quality, inserting the information into the image, and

        if the modified image is not of satisfactory quality, choosing another bit plane and repeating the steps of selecting, introducing, and determining until an image of satisfactory quality is achieved; and

        if an image of satisfactory quality can not be achieved, discarding the image as unsatisfactory for containing the information sought to be hidden.

19.   A method for hiding information in images, the method comprising:

providing an image sensor having a digital pixel sensor, analog to digital conversion circuitry, image conversion circuitry, and memory all formed on a single chip;

5   providing information sought to be hidden;

preparing the information sought to be hidden for insertion into an image;

the image sensor providing at least one original image, each original image comprising image data configured as a plurality of bit planes;

selecting a suitable bit plane for the insertion of the information sought to be

10   hidden; and

inserting the information sought to be hidden.

20.   The method of Claim 19, wherein the operation of providing the information sought to be hidden includes encoding the information in an appropriate format and

15   encrypting the information.

21.   The method of Claim 19, wherein the operations of selecting a suitable bit plane for the insertion of the information sought to be hidden and inserting the information include the steps of

20   choosing an initial bit plane;

analyzing the initial bit plane for the presence of a suitable trial insertion site;

inserting the information into the trial insertion site to create a trial image;

comparing the trial image with the original image to determine if the trial image meets with some predetermined comparison criteria,

25   if the trial image does not meet with the predetermined criteria, a different bit plane is chosen and the steps of analyzing, inserting, and comparing are repeated until a trial image meeting the criteria is selected, in the event that no trial image can be created that satisfies the criteria that original image is deemed unsuitable for storing the information; and

30   if the trial image does meet with the predetermined criteria, outputting the trial image with the inserted information as a steganographically enhanced image.

22.   A single-chip digital image sensor comprising:

a substrate having formed thereon a digital sensor array;

the digital sensor array including a plurality of light sensitive digital pixel sensors which output digital signals corresponding to an image, the digital signals having digital values corresponding to the image;

at least one memory for storing the digital values provided by the digital sensor array as a plurality of bit planes and for storing digital information sought to be inserted into the image; and

image modification circuitry, which receives from memory the plurality of bit planes corresponding to the image and the digital information sought to be inserted into the image, and analyzes the bit planes to determine a suitable site for inserting the information sought to be inserted, and which inserts the information into the suitable site to form a steganographically enhanced image.

23.   A single-chip digital image sensor as in Claim 22, wherein:

the digital sensor array includes a plurality of light sensitive digital pixel sensors which output analog signals corresponding to the image and includes supporting circuitry for converting the analog signals to the digital values corresponding to the image; and wherein

the image modification circuitry that analyzes the bit planes to determine a suitable site, analyzes the bit planes to determine a suitable bit plane for inserting the information sought to be inserted, and which inserts the information into the suitable bit plane to form a steganographically enhanced image.